**HW\_4.1**

1. Assume are Gaussian and independent. Prove are independent

Sol: It is enough they are uncorrelated.

1. Under the assumptions from (2.36) and (2.37), prove are independent for , (See text page 64)

Sol: Since

From (1), the trajectory at k is

Hence

Hence for

By the assumption,

And

In conclusion,

QED

**HW\_4.2 double integral**

1. Find the mass of the circle with radius r.

x

y

Mass =

Sol:

By the integral formula(<https://www.teachoo.com/5643/728/Integration-Formulas---Trig--Definite-Integrals-Properties-and-more/category/Miscellaneous/>)

Hence

HW\_4.3 (<https://ocw.mit.edu/courses/8-044-statistical-physics-i-spring-2013/2e4e2833e91da3a383d2d152e292cb1a_MIT8_044S13_ProbabilityCh4.pdf>)

Let . Then prove that is a Gaussian.

It is sufficient that the density of has an Gaussian exponential form as

, C is a constant .

Sol:

Since , are independent,

For simplicity, change variable as

and a constant .

The argument of the exponent can be

Now using this

Here C is a normalize factor so that

which implies

QED